MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

ECE2066 – OPERATING SYSTEMS

(CE, EE)

7 FEBRUARY 2023
9:00 A.M. - 11:00 A.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of 5 pages with 4 questions only.
2. Answer **ALL** the 4 questions. The distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1 (25 marks)

(a) What inconveniences can a user face when interacting with a computer without an operating system?

[2 marks]

(b) State and discuss FOUR (4) common services provided by an operating system.

[8 marks]

(c) Sketch the five-state process model and describe each of the state in this model.

[2 + 10 marks]

(d) Describe the relationship between process and threads.

[3 marks]

Continued...

Question 2 (25 marks)

(a) Describe the term "critical section". Subsequently, discuss the importance of a critical section in relation to controlling access to shared resources.

[4 marks]

(b) Discuss THREE (3) potential problems faced by concurrent execution of threads in a multi-threaded application due to the race condition.

[6 marks]

(c) Peterson's Algorithm is the software solution for mutual exclusion. Figure Q2(c) shows the pseudocode for Peterson's Algorithm:

Figure Q2(c): Peterson's Algorithm

```
Process Pi:
repeat
  flag[i]:=true;  // i want in
  turn:=j;        // but i let j in

  while (flag[j]&turn=j){};
     CS
  flag[i]:=false; // i no longer want in
     RS
forever
```

(i) Define the term **mutual exclusion**. Subsequently, explain how mutual exclusion can be preserved based on the code in Figure Q2(c).

[5 marks]

(ii) Based on the Peterson's Alglrithm as shown in Figure Q2(c), discuss how the progress and bounded waiting requirements of mutual exclusion can be satisfied.

[6 marks]

(d) Discuss the *wait* operation and *signal* operation of a semaphore.

[4 marks]

Continued...

Question 3 (25 marks)

(a) CPU scheduling is the basis of multiprogrammed operating systems. Discuss each of the following criteria in the context of CPU scheduling:

(i) CPU utilization

[2 marks]

(ii) Throughput

[2 marks]

(iii) Waiting time

[2 marks]

(b) Describe TWO (2) advantages of using unequal-size partitions in a fixed-partitioning scheme.

[4 marks]

(c) Assume that five processes (P1, P2, P3, P4, and P5) arrive at time 0 and they are ready to be executed. Table Q3(c) shows the burst time of the processes:

Table Q3(c)

Processes	Burst Time (millisecond)
P1	10
P2	6
P3	23
P4	9
P5	31

Describe the operation of each of the following scheduling algorithms. Then, calculate the average waiting time for each of the algorithm.

(i) First-come, First-Served (FCFS)

[4 marks]

(ii) Shortest-Process-Next (SPN)

[4 marks]

(iii) Highest-Response-Ratio Next (HRRN)

[7 marks]

Continued...

Question 4 (25 marks)

(a) Discuss the **Pile** and **Sequential** file organization methods. Subsequently, discuss the advantages and disadvantages of each of the file organization methods.

[8 marks]

(b) What file organization method would you choose to maximize efficiency in terms of speed of access, use of storage space, ease of updating, (adding/deleting/modifying) when the data are:

(i) updated infrequently, and accessed frequently in random order?

[1 mark]

(ii) updated frequently, and accessed frequently?

[1 mark]

(iii) updated frequently, and accessed frequently in random order?

[1 mark]

(c) You want to format a partition with NTFS (New Technology File Format), and the data consists of many small files. In order to use as little space as possible, should you choose a larger or smaller allocation unit size during the formatting process? Justify your answer.

[3 marks]

(d) Consider a sequential file of 20000 words. Two records of this file, namely, R_1 and R_2, must be accessed. On average, how many accesses are required to locate them if the records:

(i) Can lie anywhere in the file?

[3 marks]

(ii) Are known to be adjacent records?

[3 marks]

(e) Consider a file system that uses in-memory file allocation table for indexing the disk blocks. Each table entry requires 8 bytes of storage. For a 20 terabyte disk and a 20 kilobyte block size, calculate the maximum memory size required to hold the file allocation table. Next, discuss the suitability of in-memory file allocation table for a system with large disks.

[5 marks]

End of paper